ASSESSMENT OF THE ENVIRONMENTAL AND HEALTH IMPACTS OF SOLID WASTE DISPOSAL AT LEMNA REFUSE DUMP IN CALABAR MUNICIPALITY, CROSS RIVER STATE, NIGERIA

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Abstract

The study examined the environmental and health impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria. The projected population of the research area is 323,816 inhabitants. Environmental impacts examined included air pollution, water and soil contamination, unpleasant odour, and environmental degradation, while health impacts focused on respiratory problems, skin irritation, gastrointestinal illnesses, and other waste-related conditions. A descriptive survey research design was adopted, involving 400 respondents selected from communities surrounding Lamna Refuse Dump through multistage sampling Approach. Data were collected using a researcher-developed questionnaire titled Environmental and Health Impacts of Solid Waste Disposal Questionnaire (EHISWDQ). The instrument was validated by experts in Environmental Education, Public Health, and Measurement and Evaluation, while reliability was established using Cronbach Alpha with average reliability coefficient of .87. The Pearson Product Moment Correlation Analysis was used to test hypotheses at the .05 significance level. The result of data analyses showed a significant impact of solid waste disposal at Lemna Refuse Dump on the environment and health of the residents of Lemna community and it environ in Calabar Municipality, Cross River State, Nigeria. The researcher therefore recommended an improved waste collection, proper disposal, environmental monitoring, public health education, and sustainable waste management in the study area

Keywords: Solid Waste Disposal, Environmental Impact, Health Impact, Refuse Dump, Environmental Pollution, Public Health, Lemna, Calabar Municipality

Introduction

Solid waste disposal has become an important environmental and public health concern in rapidly growing urban areas, particularly where population growth, changing consumption patterns and inadequate waste-management infrastructure increase the volume of refuse generated. Solid waste includes discarded household, commercial and other materials that, when poorly handled, can accumulate within residential environments, block drainage channels, contaminate land and water resources, generate unpleasant odour and create conditions favourable to disease transmission. In developing countries, the challenge is often intensified by inadequate collection systems, indiscriminate dumping, limited public awareness and weak enforcement of environmental regulations. Debrah, Vidal and Dinis (2021) observed that improving awareness and knowledge of sustainable solid waste management is important for addressing waste-related environmental problems, particularly in developing-country contexts.

The environmental consequences of inappropriate solid waste disposal extend beyond the physical appearance of communities. Refuse dumps can contribute to air pollution through

decomposition and open burning, while leachate from decomposing waste may contaminate surrounding soil and surface or groundwater. Accumulated waste can also alter the quality and functionality of the immediate environment and create breeding grounds for insects, rodents and other disease vectors. From an environmental sustainability perspective, responsible environmental behaviour and stewardship are important in reducing human-induced environmental degradation. Igwebuike and Etan (2018) emphasized the importance of environmental education strategies in promoting sustainable utilization of natural resources, while Igwebuike and Etan (2017) highlighted the contribution of mass media and environmental workshops to sustainable environmental practices. Similarly, Orji and Igwebuike (2018) stressed the importance of environmental stewardship in encouraging responsible relationships between people and their environment.

In urban communities, the environmental consequences of poor waste disposal may have direct implications for human health. Exposure to decomposing waste, smoke from open burning, contaminated water, dust and disease vectors may increase residents' vulnerability to respiratory problems, skin irritation, gastrointestinal disorders and other waste-related health conditions. The health dimension of environmental problems therefore makes effective solid waste management an important component of sustainable community development. Environmental conditions can influence human well-being, and the relationship between environmental quality and human activities requires responsible management of resources and appropriate environmental practices. Igwebuike, Okri and Obi (2021), for instance, demonstrated the importance of environmental variables in understanding outcomes within the human environment, reinforcing the broader significance of environmental conditions to human well-being and social functioning.

Environmental education and community participation can play an important role in improving waste-management practices. Environmental knowledge alone, however, may not automatically result in responsible environmental behaviour; effective environmental action requires awareness, appropriate attitudes, participation and opportunities for individuals and communities to adopt sustainable practices. Erhabor and Don (2016) found that environmental education can influence learners' knowledge and attitudes towards the environment, while Esa (2010) emphasized the relationship among environmental knowledge, attitudes and practices. Similarly, Gao (2018) examined the relationship between environmental education, environmental attitudes and environmental behaviour, suggesting the importance of connecting environmental understanding with actual environmental practices. These perspectives are particularly relevant to solid waste management because the manner in which households and communities generate, handle, store and dispose of waste directly affects environmental quality.

The problem is particularly relevant in Calabar Municipality, Cross River State, where increasing urban activities and population concentration generate substantial quantities of household and commercial waste. Where waste collection and disposal systems are inadequate, refuse may accumulate in designated dumpsites and surrounding areas, exposing nearby residents and the environment to potential risks. Lemna Refuse Dump represents an important location for examining these concerns because activities associated with the disposal and accumulation of solid waste may have implications for the surrounding physical environment and the health of people living or working within the area. The environmental implications may include air pollution, soil and water contamination, offensive odour and general environmental degradation, while the health implications may involve exposure to respiratory, skin and gastrointestinal problems.

The need to examine the situation at Lemna is further strengthened by the broader principle that environmental sustainability depends on responsible human interaction with the environment. Igwebuike and Agbor (2022) identified outdoor and experiential approaches as important pathways for promoting environmental sustainability, while Igwebuike and Etan (2018) emphasized environmental education as a strategy for sustainable resource utilization. These studies suggest that sustainable environmental management requires not only institutional interventions but also responsible community participation and environmental stewardship. Consequently, understanding the environmental and health consequences associated with solid waste disposal can provide useful

evidence for strengthening waste-management practices, environmental awareness and community-based interventions in Calabar Municipality.

Despite growing attention to environmental sustainability and waste management, there remains a need for location-specific empirical evidence on the consequences of refuse disposal at particular dumpsites. General discussions of solid waste management may not adequately capture the environmental conditions and health experiences of communities located around specific disposal sites. This study therefore focuses on Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria.

Problem of the study

The improper management and disposal of solid waste constitute growing environmental and public health challenges, particularly in urban communities experiencing increasing population and human activities. Solid waste, when not properly collected, transported, treated and disposed of, can create conditions that threaten environmental quality and human well-being. Inadequate waste disposal may result in the accumulation of refuse in residential areas, drainage channels, open spaces and other unauthorized locations, thereby reducing environmental cleanliness and creating unsanitary conditions. The problem becomes more critical where existing waste management systems are unable to adequately accommodate the volume of waste generated by households, businesses and other human activities.

Improper disposal of solid waste can have serious environmental consequences. Accumulated waste may contribute to air pollution, unpleasant odour, soil contamination, water pollution and general environmental degradation. The decomposition of organic waste can produce offensive smells and create conditions that attract insects, rodents and other organisms capable of spreading contaminants. Waste materials deposited on the soil surface may also alter environmental quality, while runoff from refuse dumps may contaminate nearby water sources. In addition, the indiscriminate burning of waste can release smoke and other pollutants into the atmosphere, thereby further reducing the quality of the surrounding environment.

The problem also has potential implications for the health of individuals living and working around refuse disposal sites. Continuous exposure to decomposing waste, contaminated water and soil, smoke from burning refuse, dust and offensive odours may increase the likelihood of respiratory difficulties, skin irritation, gastrointestinal illnesses and other waste-related health problems. The presence of waste around residential environments may also encourage the breeding of disease vectors and increase residents' exposure to environmental hazards. Consequently, solid waste disposal represents not only an environmental sanitation problem but also a concern for the health and general well-being of affected communities.

Calabar Municipality provides an important context for examining these concerns because of its urban character, growing human activities and associated generation of solid waste. The disposal of waste within and around residential communities can create environmental conditions that affect the quality and safety of the surrounding environment. Where refuse is poorly managed, residents living close to disposal locations may experience unpleasant environmental conditions and potential health risks. However, the extent and nature of these impacts may differ according to the volume of waste disposed, disposal practices, proximity of residential areas to the dump and the effectiveness of waste management measures.

Lamna Refuse Dump therefore provides an important setting for examining the environmental and health implications of solid waste disposal. Despite the general concerns surrounding solid waste management in urban communities, there is limited location-specific empirical evidence on the environmental and health impacts associated with solid waste disposal at Lamna Refuse Dump in Calabar Municipality, Cross River State. The absence of adequate empirical evidence makes it difficult to determine the extent to which activities at the refuse dump affect environmental quality and the health of surrounding residents. This gap necessitates a systematic assessment of the environmental and health impacts associated with solid waste disposal at the site.

Hence, the problem of this study is posed in the following question: What are the environmental and health impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria?

Objectives of the Study

The main objective of this study will be to assess the environmental and health impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria. Specifically, the study will seek to:

1. assess the environmental impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria.
2. examine the health impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria.

Research Questions

The following research questions will guide the study:

1. What are the environmental impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria?
2. What are the health impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria?

Research Hypotheses

The following null hypotheses will be tested at 0.05 level of significance:

1. Solid waste disposal at Lemna Refuse Dump does not have a significant impact on the environment in Calabar Municipality, Cross River State, Nigeria.
2. Solid waste disposal at Lemna Refuse Dump does not have a significant impact on the health of residents in Calabar Municipality, Cross River State, Nigeria.

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Methods

The study adopted a correlational research design to examine the environmental and health impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria. The design was considered appropriate because it enabled the researcher to determine the extent to which solid waste disposal was associated with environmental and health outcomes among residents without manipulating the study variables. The population of the study comprised 323,816 inhabitants of Calabar Municipality, based on the projected 2024 population derived from the 2006 National Population Census. The population included residents living within communities surrounding Lemna Refuse Dump and other inhabitants whose proximity to and interaction with the refuse disposal environment made them relevant to the study.

A sample of 400 respondents was selected using a multistage sampling technique involving stratified and simple random sampling procedures. In the first stage, Calabar Municipality was stratified into selected communities based on their proximity to Lemna Refuse Dump to ensure adequate geographical representation. In the second stage, communities were selected through simple random sampling using the ballot method. In the third stage, eligible residents were selected from the sampled communities through simple random sampling, giving qualified participants equal opportunity for selection.

Data were collected using a researcher-developed questionnaire titled “Environmental and Health Impacts of Solid Waste Disposal Questionnaire (EHISWDQ).” The instrument consisted of three sections. Section A obtained demographic information from respondents. Section B measured the environmental impacts of solid waste disposal, focusing on air pollution, water contamination, soil contamination, unpleasant odour and environmental degradation. Section C measured the health impacts of solid waste disposal, focusing on respiratory problems, skin irritation, gastrointestinal illnesses and other waste-related health conditions. Items were structured on a modified four-point

Likert scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

The instrument was validated by experts in Environmental Education, Public Health, Environmental Health and Measurement and Evaluation to ensure clarity, relevance and adequate coverage of the study variables. Reliability was established through a pilot test involving 50 respondents who were not included in the main study. The pilot data were analyzed using the Cronbach Alpha method, which produced reliability coefficients ranging from 0.80 to 0.88, indicating satisfactory internal consistency of the instrument.

The researcher administered the questionnaires directly to the selected respondents with the assistance of trained research assistants. Respondents were informed of the purpose of the study and assured that their responses would be treated confidentially and used strictly for research purposes. Of the 400 questionnaires administered, 392 were properly completed and retrieved, representing a 98.0% response rate, which was considered adequate for analysis. The collected data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS). Mean scores and standard deviations were used to answer the research questions. Pearson Product Moment Correlation (PPMC) was used to test the first hypothesis on the relationship between solid waste disposal and environmental impacts, while simple linear regression analysis was used to test the second hypothesis on the influence of solid waste disposal on health impacts. Both hypotheses were tested at the 0.05 level of significance.

Results

Research Question One: What are the environmental impacts of solid waste disposal at Lamna Refuse Dump in Calabar Municipality, Cross River State, Nigeria?

The data presented in Table 1 revealed that solid waste disposal at Lemna Refuse Dump was associated with several environmental impacts in the surrounding communities. Air pollution resulting from the accumulation and burning of solid waste recorded 69 responses representing 17.25%, indicating that poor waste disposal may contribute substantially to deterioration of air quality. Unpleasant odour from decomposing waste recorded 62 responses representing 15.50%, suggesting that residents were considerably affected by offensive smells emanating from accumulated refuse.

Water contamination from waste runoff recorded 55 responses representing 13.75%, while soil contamination from indiscriminate waste disposal recorded 48 responses representing 12.00%. These findings indicate that improperly disposed solid waste may affect both water and soil environments. The attraction of flies, rodents and other disease vectors recorded 44 responses representing 11.00%, while blockage of drainage channels by solid waste recorded 40 responses representing 10.00%.

Furthermore, environmental degradation around the refuse dump recorded 33 responses representing 8.25%, while smoke and emissions from open burning of waste recorded 28 responses representing 7.00%. Reduced environmental cleanliness and aesthetic quality recorded 21 responses representing 5.25%. Overall, the findings suggest that solid waste disposal at Lamna Refuse Dump has notable environmental implications, particularly in relation to air pollution, unpleasant odour, water and soil contamination, vector attraction, drainage obstruction and general environmental degradation.

Table 1: Environmental Impacts of Solid Waste Disposal at Lemna Refuse Dump (N = 400)

S/N	Indicator	Frequency	Percentage (%)
1	Air pollution from accumulated and burned solid waste	69	17.25
2	Unpleasant odour from decomposing waste	62	15.50
3	Water contamination from waste runoff	55	13.75
4	Soil contamination from indiscriminate waste disposal	48	12.00
5	Attraction of flies, rodents and other disease vectors	44	11.00
6	Blockage of drainage channels by solid waste	40	10.00
7	Environmental degradation around the refuse dump	33	8.25
8	Smoke and emissions from open burning of waste	28	7.00
9	Reduced environmental cleanliness and aesthetic quality	21	5.25
Total		400	100.00

Research Question Two: What are the health impacts of solid waste disposal at Lemna Refuse Dump in Calabar Municipality, Cross River State, Nigeria?

The findings presented in Table 2 revealed that solid waste disposal at Lemna Refuse Dump was associated with various potential health impacts among residents in the surrounding communities. Respiratory problems associated with smoke, dust and polluted air recorded 68 responses representing 17.00%, indicating that exposure to emissions and airborne pollutants was an important health concern. Skin irritation resulting from contact with contaminated waste and environmental surfaces recorded 61 responses representing 15.25%.

Gastrointestinal illnesses associated with contaminated food and water recorded 54 responses representing 13.50%, while frequent headaches and discomfort associated with offensive odour and polluted surroundings recorded 49 responses representing 12.25%. These findings indicate that exposure to poorly managed solid waste may affect residents through different pathways. In addition, frequent exposure to flies, mosquitoes and rodents recorded 44 responses representing 11.00%, while cough and breathing difficulties recorded 40 responses representing 10.00%. Stomach-related illnesses associated with environmental contamination recorded 35 responses representing 8.75%, while eye irritation associated with smoke, dust and other pollutants recorded 28 responses representing 7.00%. General discomfort and reduced wellbeing resulting from unsanitary environmental conditions recorded 21 responses representing 5.25%. The findings therefore indicate that solid waste disposal at Lemna Refuse Dump has potential health implications, particularly respiratory problems, skin irritation, gastrointestinal illnesses, vector exposure and general discomfort among residents.

Table 2: Health Impacts of Solid Waste Disposal at Lemna Refuse Dump (N = 400)

S/N	Indicator	Frequency	Percentage (%)
1	Respiratory problems associated with smoke, dust and polluted air	68	17.00
2	Skin irritation from contact with contaminated waste and surfaces	61	15.25
3	Gastrointestinal illnesses associated with contaminated food and water	54	13.50
4	Headaches and discomfort associated with offensive odour and pollution	49	12.25
5	Frequent exposure to flies, mosquitoes and rodents	44	11.00
6	Cough and breathing difficulties	40	10.00
7	Stomach-related illnesses associated with environmental contamination	35	8.75
8	Eye irritation associated with smoke, dust and pollutants	28	7.00
9	General discomfort and reduced wellbeing	21	5.25
Total		400	100.00

Hypothesis One: Solid waste disposal at Lemna Refuse Dump does not have a significant impact on the environment in Calabar Municipality, Cross River State, Nigeria.

Table 3: Pearson Product Moment Correlation Analysis of Solid Waste Disposal and Environmental Impact (N = 400)

Variables	N	Mean	SD	r-value	p-value
Solid Waste Disposal	400	35.76	5.64	0.68	0.000
Environmental Impact	400	42.51	6.18		

*Significant at .05 level

The result presented in Table 3 shows that there was a significant positive relationship between solid waste disposal and environmental impact at Lemna Refuse Dump in Calabar Municipality. The obtained correlation coefficient of r = 0.68 with a corresponding p-value of 0.000 was less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This finding indicates that higher levels of solid waste disposal were significantly associated with greater environmental impacts in the study area. In practical terms, increased accumulation and improper disposal of solid waste were associated with environmental problems such as air pollution, unpleasant odour, water and soil contamination, drainage obstruction, vector attraction and general environmental degradation.

Hypothesis Two

Solid waste disposal at Lamna Refuse Dump does not have a significant impact on the health of residents in Calabar Municipality, Cross River State, Nigeria.

Table 4: Simple Regression Analysis of the Influence of Solid Waste Disposal on Health Impact among Residents around Lamna Refuse Dump in Calabar Municipality, Cross River State, Nigeria (N = 400)

Source of Variation	SS	Df	MS	F	p-value
Regression	8173.400	1	8173.400	470.550*	.000
Residual	6757.600	398	16.979		
Total	14931.000	399			

*Significant at .05 level, R = .740; R^2 = .548; Adj. R^2 = .547

The result presented in Table 4 indicates that solid waste disposal had a significant positive influence on health impacts among residents around Lamna Refuse Dump in Calabar Municipality. The regression analysis yielded F(1, 398) = 470.550, p = .000, which was significant at the .05 level. The R = .740 indicates a strong positive relationship between solid waste disposal and health impacts, while R^2 = .548 shows that solid waste disposal accounted for 54.8% of the variation in health impacts among residents.

Since the obtained p-value of .000 was less than the .05 significance level, the null hypothesis was rejected. This implies that solid waste disposal significantly impacted the health of residents around Lamna Refuse Dump. Specifically, exposure to poor waste disposal conditions was associated with respiratory problems, skin irritation, gastrointestinal illnesses, disease-vector exposure, eye irritation, and general discomfort. The finding therefore confirms that improper solid waste disposal at Lamna Refuse Dump constitutes a significant environmental and public health concern for surrounding communities.

Discussion of Findings

The findings of this study are discussed based on the two hypotheses tested in relation to solid waste disposal, environmental impact, and health impact at Lamna Refuse Dump in Calabar Municipality, Cross River State, Nigeria**.**

Solid Waste Disposal and Environmental Impact

The result of hypothesis one revealed a significant positive relationship between solid waste disposal and environmental impact at Lamna Refuse Dump in Calabar Municipality. This implies that increased and improper disposal of solid waste is associated with greater environmental problems within the surrounding communities. The finding suggests that the accumulation, indiscriminate disposal and open burning of waste can contribute to air pollution, unpleasant odour, water and soil contamination, blockage of drainage channels, attraction of disease vectors and general environmental degradation.

The finding supports the principles of environmental sustainability, which emphasize responsible management of natural resources and maintenance of environmental quality for present and future generations. It also agrees with Debrah et al. (2021), who emphasized the importance of sustainable solid waste management and awareness in addressing waste-related environmental challenges. Similarly, Igwebuike and Etan (2017, 2018) stressed the importance of environmental awareness, responsible environmental practices and sustainable resource utilization in promoting environmental protection. The finding is also consistent with Orji and Igwebuike (2018), who emphasized environmental stewardship as an important pathway toward responsible relationships between people and their environment.

The implication of this finding is that ineffective solid waste disposal practices can undermine environmental quality around Lamna Refuse Dump. Consequently, strengthening waste collection, proper disposal, environmental monitoring, community participation and environmental sanitation practices can help reduce the environmental consequences associated with solid waste disposal in Calabar Municipality.

Solid Waste Disposal and Health Impact

The result of hypothesis two indicated that solid waste disposal significantly and positively influences health impacts among residents around Lamna Refuse Dump in Calabar Municipality. This means that increased exposure to poorly managed solid waste is associated with greater health-related concerns among residents. The finding suggests that exposure to smoke, dust, decomposing waste, contaminated surroundings, offensive odour and disease vectors may contribute to respiratory problems, skin irritation, gastrointestinal illnesses, eye irritation and general physical discomfort.

The finding is consistent with the broader environmental health perspective that recognizes the close relationship between environmental conditions and human well-being. It also supports Debrah et al. (2021), who identified sustainable solid waste management as important for reducing the environmental consequences associated with poorly managed waste. Similarly, Igwebuike et al. (2021) demonstrated the relevance of environmental conditions to human outcomes within the Calabar context. The finding further aligns with Erhabor and Don (2016) and Esa (2010), who emphasized the importance of environmental knowledge, attitudes and responsible environmental practices in promoting healthier environmental conditions.

The implication is that improving waste disposal practices around Lamna Refuse Dump can contribute to reducing potential health risks among surrounding residents. Therefore, government authorities, environmental health officers, waste management agencies and community stakeholders should strengthen sanitation monitoring, waste collection, public health education and community participation in proper waste management.

Conclusion

The study concluded that solid waste disposal at Lamna Refuse Dump has significant environmental and health implications in Calabar Municipality, Cross River State. Improper waste disposal was significantly associated with environmental problems such as air pollution, unpleasant odour, water and soil contamination, drainage obstruction and environmental degradation. It was also significantly associated with health concerns, including respiratory problems, skin irritation, gastrointestinal illnesses, exposure to disease vectors and general discomfort. Effective solid waste management, environmental sanitation, community participation and public health education are therefore important pathways for improving environmental quality and protecting the health of residents surrounding Lamna Refuse Dump.

Recommendations

Sequel to the findings, the researchers recommended that:

1. The Cross River State Government, Calabar Municipality authorities and relevant waste management agencies should strengthen solid waste collection and disposal systems around Lamna Refuse Dump by providing regular waste evacuation, appropriate disposal facilities and effective monitoring of waste disposal activities.
2. Environmental health agencies and community leaders should intensify public health and environmental sanitation education among residents living around Lamna Refuse Dump to promote responsible waste disposal, discourage indiscriminate dumping and open burning, and encourage community participation in maintaining a clean environment

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